



Leveraging Executable Architectures in a Joint Environment

MICHAEL J. SPITZ

Senior Analyst Engineer, SAIC

USJFCOM/J892 Capability Engineering

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Purpose

Detail analysis utilizing executable architectures and demonstrate its capabilities to support Joint Systems Engineering analysis



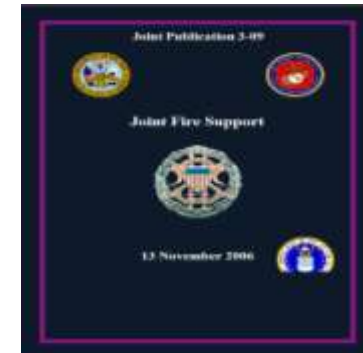
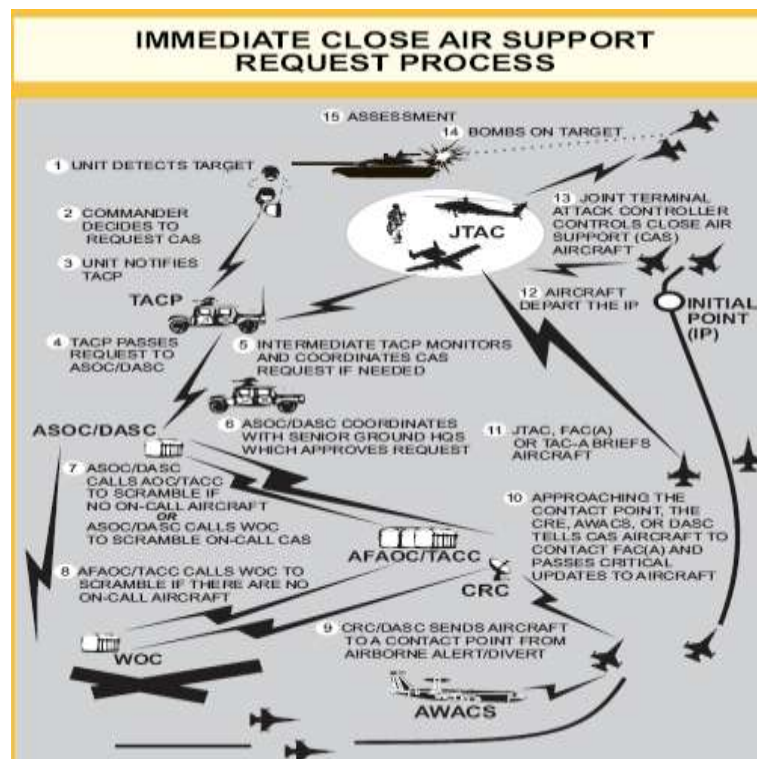
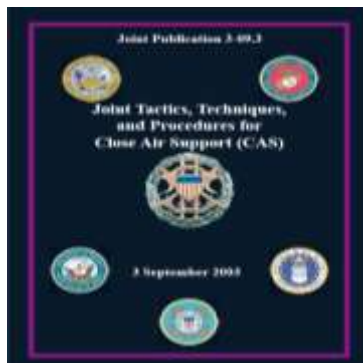
Overview

- Developing Enterprise Architecture
- Using Activity Models to develop Executable Architectures
- Leveraging Executable Architectures for use in Engineering Analysis, Testing, and Training



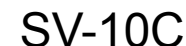
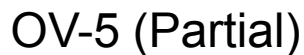
Develop Enterprise Architecture (Joint Close Air Support Example)

- **Mission Thread Decomposition**
 - Multiple Doctrinal Sources, Service Architectures
 - Subject Matter Expert Inputs
 - Decompose tasks, activities, etc





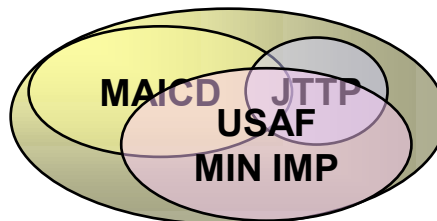
- Core for executable is detailed Activity Model
- Analyze for gaps, shortfalls, etc.

OV-3



Develop Enterprise Architecture (Joint Close Air Support Example)

- **Document Requirements, Capability, Gaps**
 - Desk Top Assessment (JCAS JBMC2 Final Report)



200 Elements

UNITED STATES JOINT FORCES COMMAND
JOINT BATTLE MANAGEMENT
COMMAND AND CONTROL

Joint Close Air Support
Joint Mission Thread

Desk Top Analysis
Final Report



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ELEMENTS											
X = Existing capability											
P1 = Partial - requires voice ack											
P2 = Partial - only some F/A-18s											
P3 = remarks only											
TARGET LOCATION & DESCRIPTION											
TGT LOC: lat/long or UTM	X	X	X	X							
Number of Targets (elementary)/TGT Strength	X	X	X	X							
Tgt ID Serial Number/TGT Name	X	X	X	X							
Tgt Elevation	X	X	X	X							
Tgt Course	X	X	X	X							
Tgt Speed	X	X	X	X							
Area tgt length, width, & altitude	X	X	X	X							
Radius (NEW)	X	X	X	X							
TGT Generic Type	X	X	X	X							
Expanded TGT Description	X	X	X	X							
Target Subtype	X	X	X	X							
A/C WPN SYS AIM POINT (SPI/DGT)											
Design TGT LOC (A/C RPT)	X	X	X	X							
Design TGT Elev (A/C RPT)	X	X	X	X							
Design TGT Source (A/C RPT)	X	X	X	X							
JBFS											
Closest friendly LOC lat - long / UTM to tgt	X	X	X	X							
Friendly unit elevation	X	X	X	X							
Number of Friendly Forces	X	X	X	X							
Type of Friendly Forces	X	X	X	X							
Direction of Friendlies from the target	X	X	X	X							
Distance to Friendlies from the target	X	X	X	X							
Confirm Friendlies	X	X	X	X							
Subtype	X	X	X	X							
Size	X	X	X	X							
Orientation	X	X	X	X							
Activity	X	X	X	X							
Course	X	X	X	X							
Speed	X	X	X	X							

JBFS											
Closest friendly LOC lat - long / UTM to tgt	X	X	X	X							
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Size	X	X	X	X							
Orientation	X	X	X	X							
Activity	X	X	X	X							
Course	X	X	X	X							
Speed	X	X	X	X							



Develop Executable Architecture

- **Simulation tools provide capability to compare processes, time, costs, return on investments**
 - Input Time/Resources (distributions)
 - Map to Requirements, Tasks, etc.
- **Scenario-based**
- **Assumptions**

The screenshot shows the 'Attributes - 1. Initiate CFF' window in the WBM software. The 'Simulation Control Panel' tab is active, and the 'Duration' sub-tab is selected. Under the 'Processing time' section, the 'Distribution' is set to 'Poisson' and the unit is 'Minute'. The 'Mean' value is set to '1.0'. A histogram labeled 'Sample' is displayed, showing a distribution of values. The text 'Useful in characterizing discrete events occurring independently of one another in time.' is also present.

Attributes - 1. Initiate CFF X Simulation Control Panel Business Measures Errors (Filter matched 53 of 53 items) Dynamic Analysis

General Cost and Revenue Duration Inputs Outputs Input Logic Output Logic Resources Organizati

▼ Processing time

The length of time required to finish this task.

Distribution ▼

Poisson ▼ Minute ▼

Useful in characterizing discrete events occurring independently of one another in time.

Mean

1.0

Sample

Sample Distributions in WBM

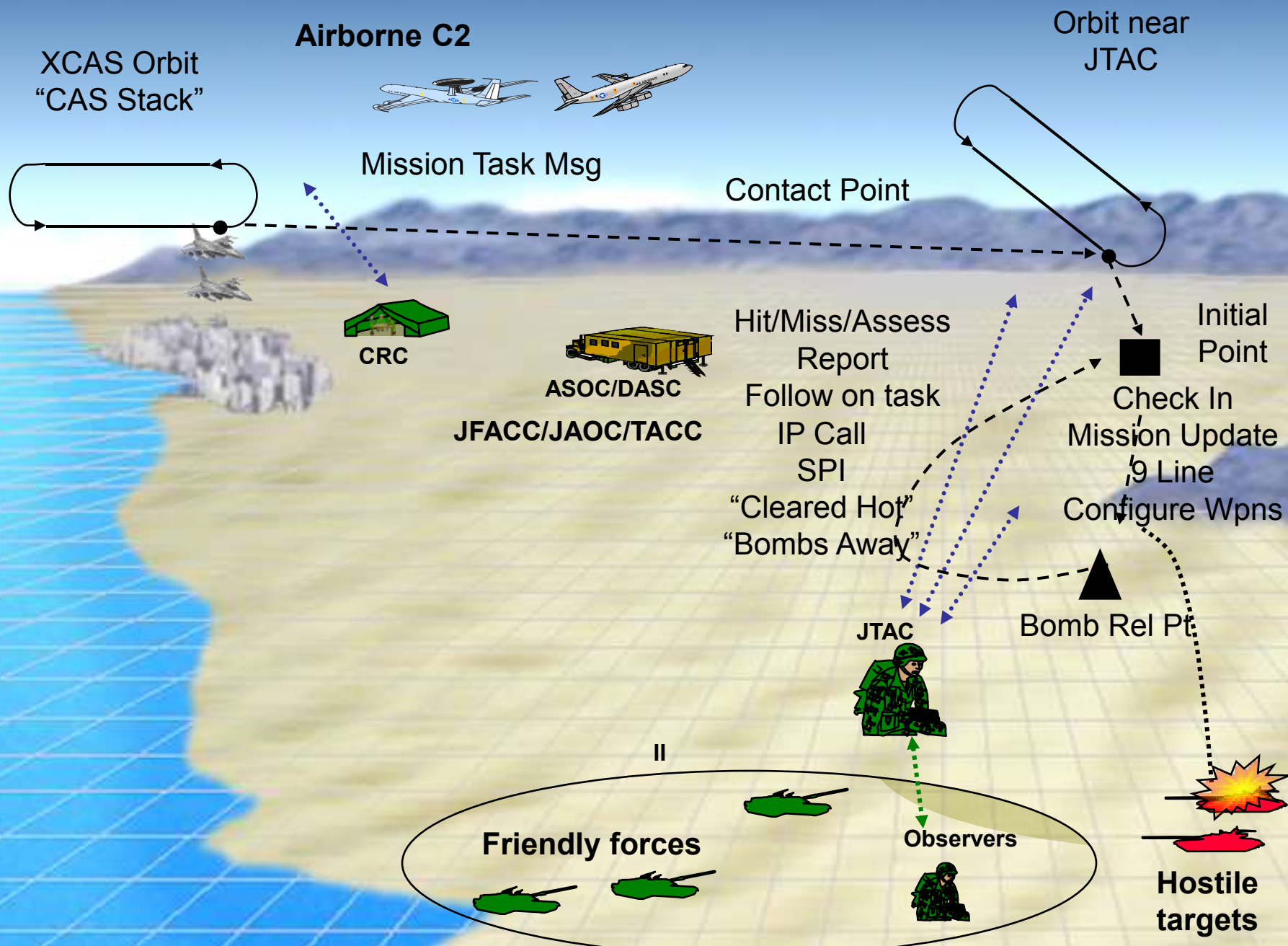


JCAS Example

(Digital vs. Voice Comparison)

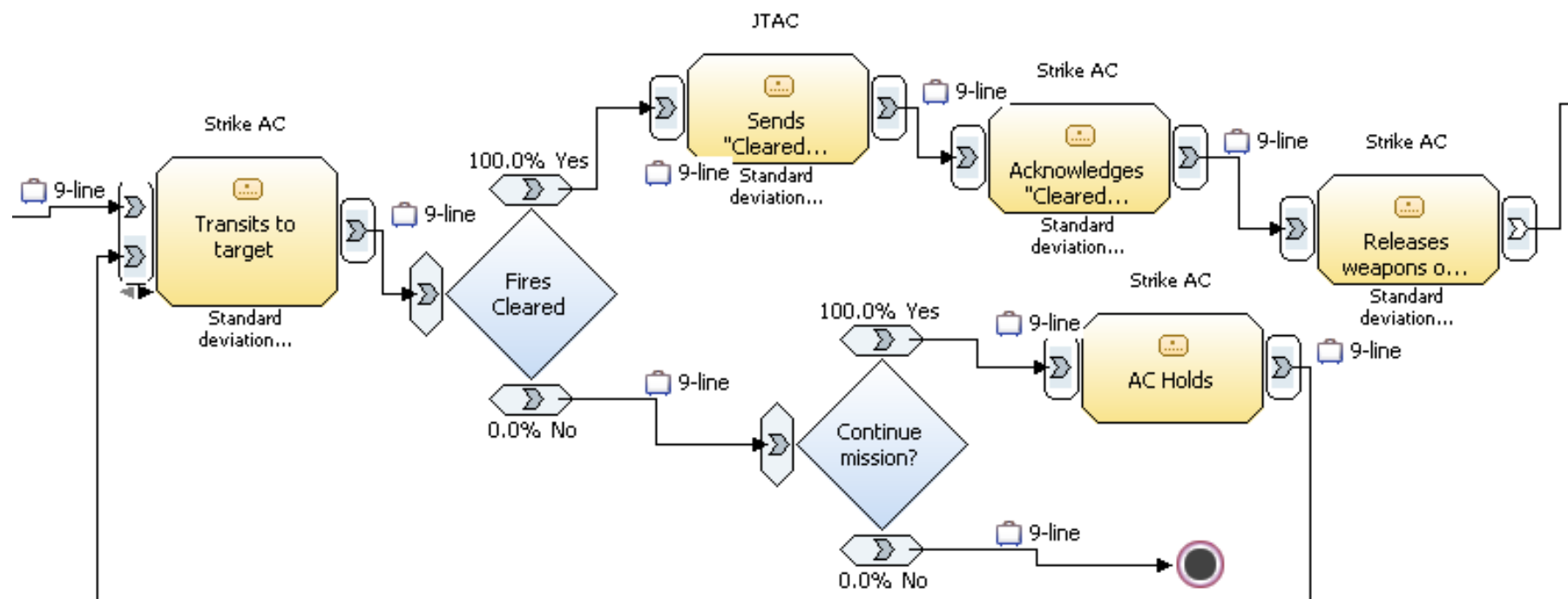
- **Compare process from mission assignment to mission completion using "as is" architecture against a "to be" architecture that maximizes digital transmissions.**
- **Model: JCAS Model Scenario:**
 - Scenario 1: Aircraft in XCAS Stack conducts mission from Mission Assignment to BDA
 - Scenario 2: Aircraft conducts entire mission from Contact Point
- **Metrics**
 - Time between Voice “As is” and Digital “To Be”
 - Capability increase
 - Accuracy

JCAS JMT (Digital vs. Voice Scenario)





Executable Architecture (Joint Close Air Support Example)

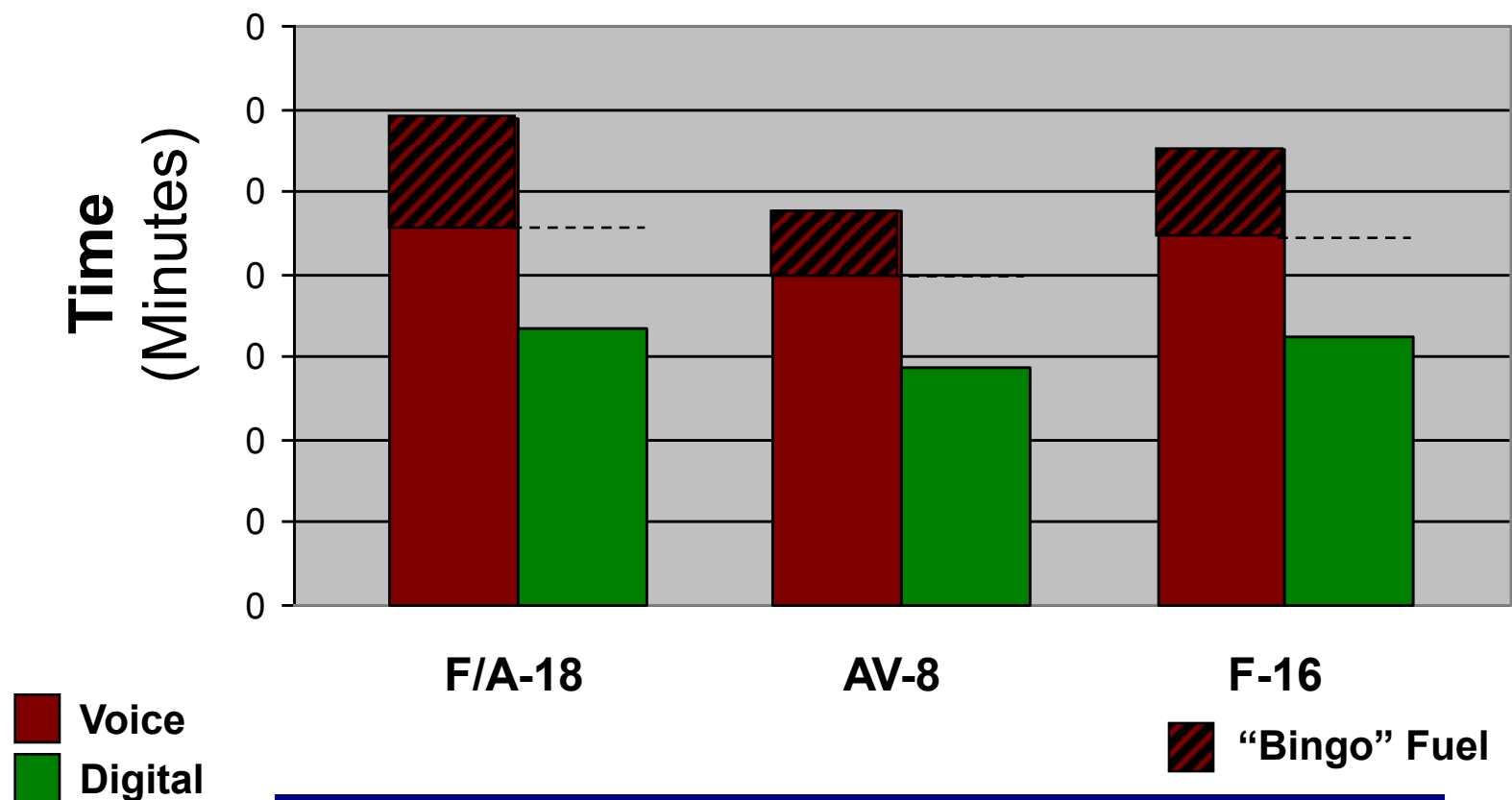


USJFCOM/J89 JCAS Executable Architecture (Partial View)



Digital vs. Voice Comparison Results

Complete XCAS Mission
(mission assignment through mission completion)



40-44% Time Savings Using Digital
More Weapons Employed, More Fuel Available



Digital vs. Voice Analyzed

10 Day Operations

	A-10		F-16		F/A-18		B-1		B-52		AV-8	
	Voice	Dig	Voice	Dig	Voice	Dig	Voice	Dig	Voice	Dig	Voice	Dig
Avg number of strikes/section	5.0	6.0	6.4	8	6.9	12.6	13.4	24	11	12	3.5	3.9
12 Ship (surge) squadron strikes (10 days)	900	1080	1151	1440	1259	2273	1605	2880	1324	1440	1050	1170
Days needed to strike same number of targets	10	8.34	10	7.99	10	5.54	10	5.57	10	9.19	10	8.97

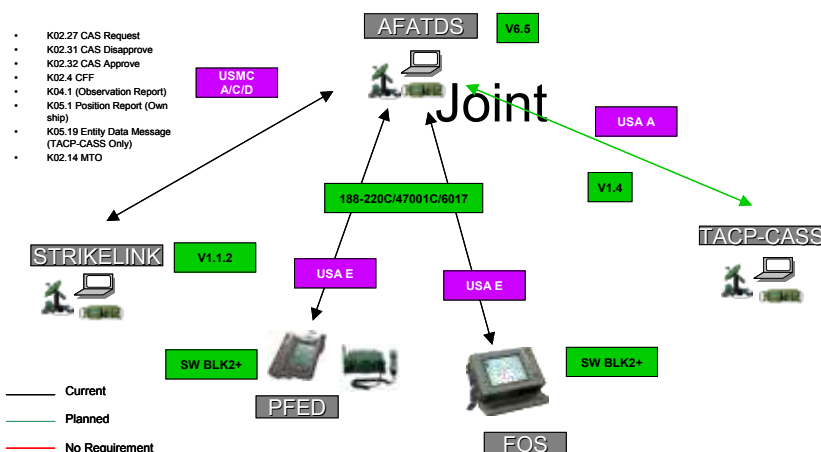
*Based on average loiter times & sortie rates

Results Feed Other Models (EADSIM, JAS, STORM, etc)



Executable Architectures Applied (Joint Close Air Support Example)

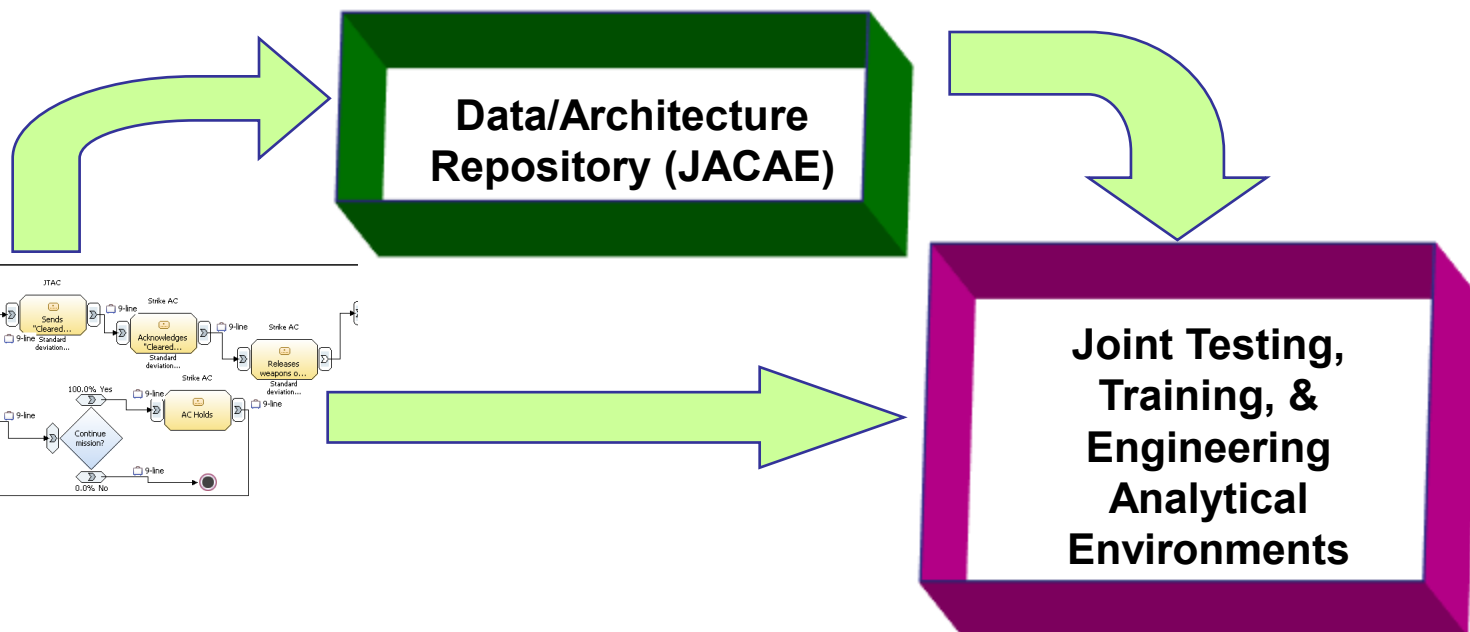
- **Operational Assessments**
 - “Bold Quest”
 - Interoperability Evaluation
- **Testing**
 - Exercise “Integral Fires 07”
 - MOE/MOPs for Test Threads
 - Timeliness
 - Accuracy
 - Traceability to Test Threads





Document for Reusability

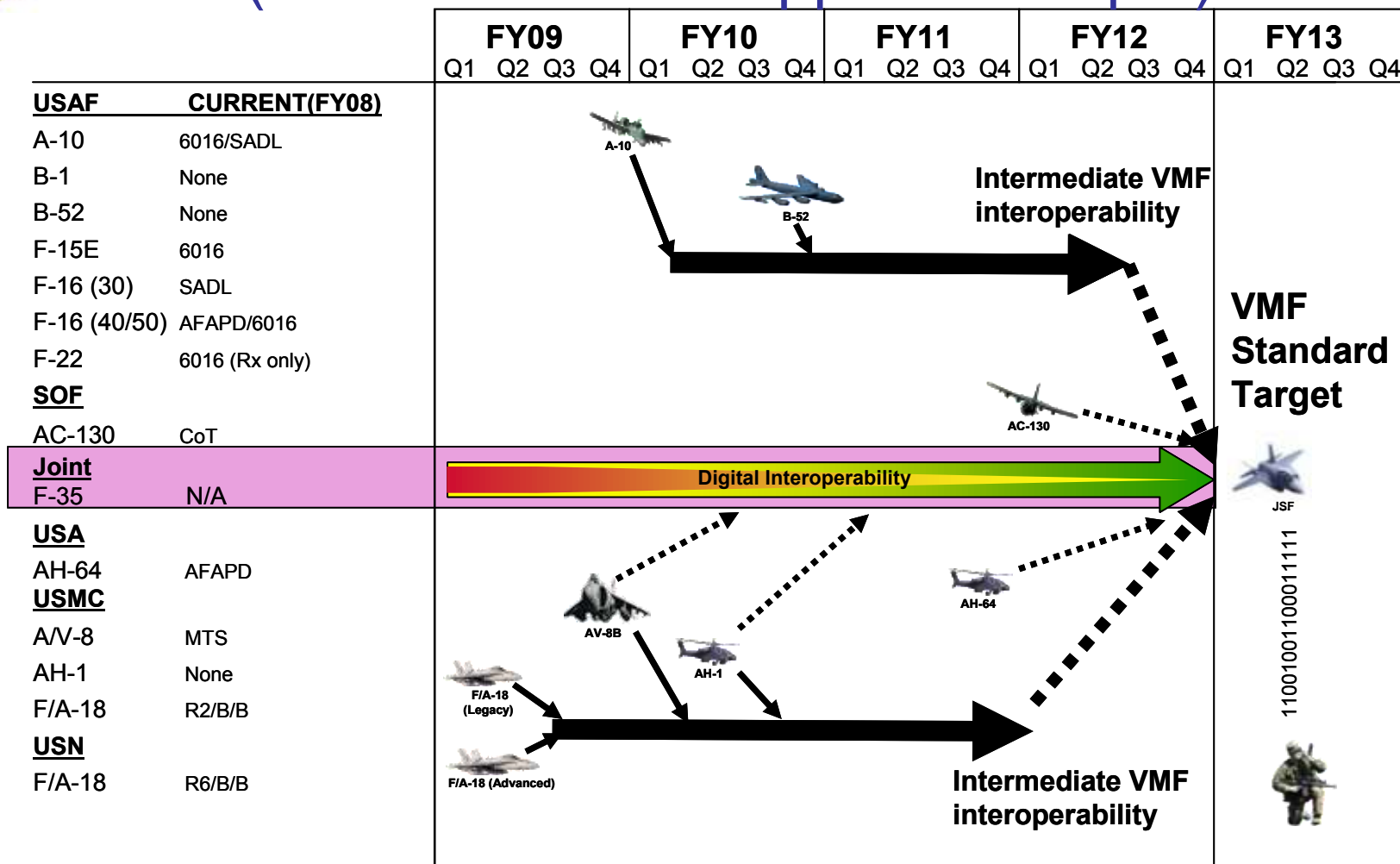
- **Objects, scenarios, tasks, sub-tasks, etc.**
 - Joint C2 (JC2) Architecture and Capability Assessment Enterprise (JACAE)
- **Available for Analytical Environments**
- **Validation, Verification, & Accreditation**
- **Coordinated Implementation**





Coordinated Implementation

(JCAS Terminal Attack Control Interoperability Timeline)



— Planned
- - - JFCOM Proposed

**Participation
Scope: TBD**





Executable Architecture Benefits

- Enables Structured Analytical Approach
 - Complete mission decomposition, including requirements, capabilities, & gaps
 - Documented through DoDAF (Core Activity Model)
 - Provides reusable repository of objects, scenarios, tasks, etc.
- Predictive Analysis
 - Generates MOE/MOPs for Gap/Trade analysis to support on going Functional Solutions Analyses
 - Results feed other models (JAS, STORM, EADSIM, etc)
 - Coordinate Implementation across Service and COCOM boundaries
- Risk Mitigation
 - Provide an environment for Joint Testing
 - Operational Assessments
 - Exercises



Summary

- Build Enterprise Architecture of a Mission Thread
 - Decompose tasks, activities, etc.
 - Document Requirements, Current Capability, Gaps
 - Documented through DoDAF (Core Activity Model)
- Using Activity Model, develop Executable Architecture
- Leverage Executable Architecture
 - Generate MOE/MOPs for Gap/Trade analysis
 - Provide an environment for Joint Testing
 - Inputs to other models (mission level/campaign level)
- Build a common repository of objects, scenarios, tasks, sub-tasks, etc.
- Reuse in Engineering Analysis, Testing, and Training

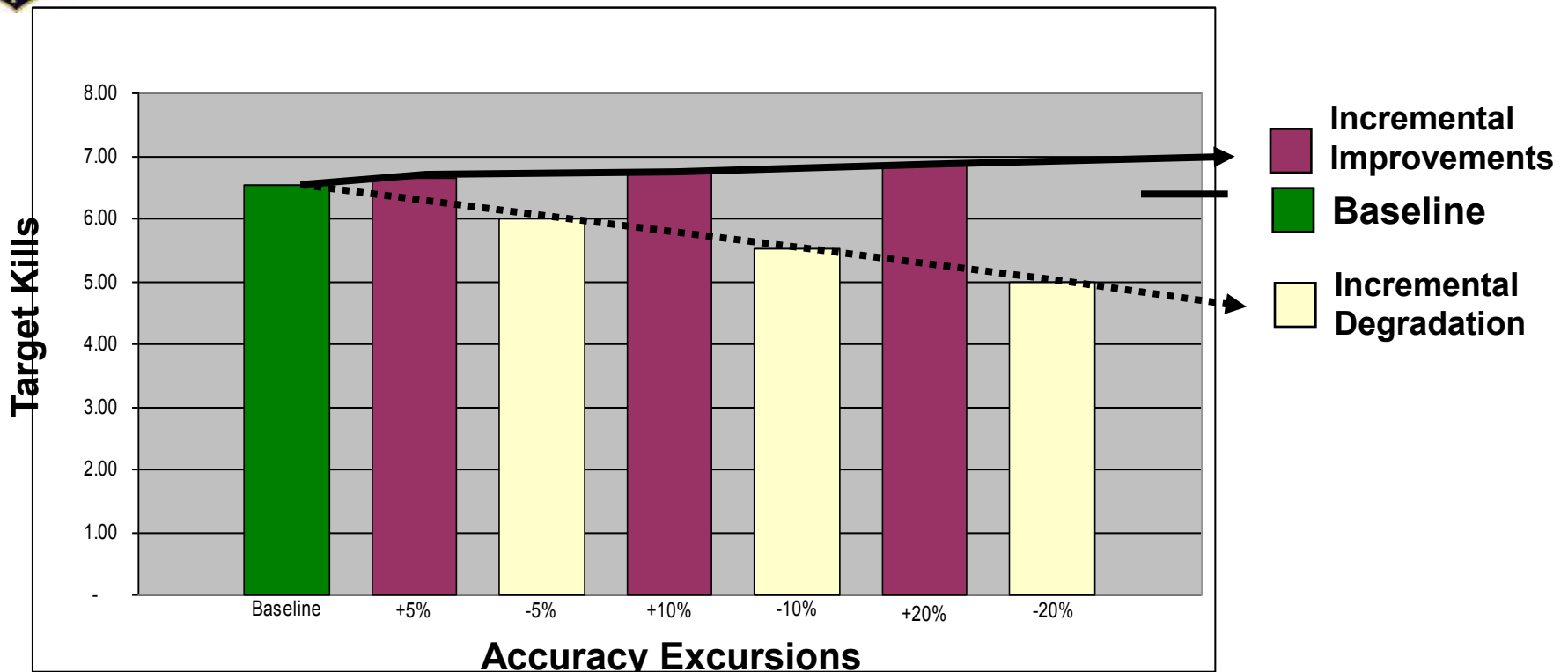




Questions



Accuracy Analysis



- Model: F/A-18 Digital Execution
- Assumptions
 - 1 x F/A-18 w/ 8 JDAM
 - 1 Target per weapon per pass
 - Lethal Radius: 60 m
 - Target Location Error: JCAS MT-3 (LRF/GPS)
 - Circular Error: Lognormal distribution between 1-40 m, centered at 13 m
 - For accuracy excursions, either incremental improvements or degradations of 5%, 10%, and 20% made to target location errors